

Claims

- [c1] What is claimed is:
1. A blow-off valve assembly comprising:
a valve body;
a blow-off valve disposed in the valve body and configured to control coolant flow through an engine based on coolant pressure; and
an actuator disposed in the valve body and configured to electro-mechanically activate the valve under certain conditions independent of coolant pressure.
 - [c2] 2. The valve assembly of claim 1 wherein the valve includes a conical end and is configured to extend axially to seal a coolant path of a cooling system.
 - [c3] 3. The valve assembly of claim 2 wherein the valve further comprises a spring connected to another end of the valve and is configured to bias the valve against a seat of the valve body to seal the coolant path.
 - [c4] 4. The valve assembly of claim 1 wherein the actuator includes a plunger connected to the valve body configured to unseat the valve under the certain conditions.

- [c5] 5. The valve assembly of claim 4 wherein the plunger includes an electro-mechanical solenoid controllable by an engine control unit (ECU) to impart a force on the valve to overcome a bias placed on the valve.
- [c6] 6. The valve assembly of claim 5 wherein the ECU activates the electro-mechanical solenoid based on engine load and speed.
- [c7] 7. The valve assembly of claim 1 wherein the valve body further includes at least one coolant inlet port configured to receive pressurized coolant circulating through a cooling system.
- [c8] 8. The valve assembly of claim 1 wherein the engine is disposed in an outboard motor.
- [c9] 9. An outboard motor comprising:
an internal combustion engine;
a cooling system having a number of coolant passages to circulate coolant about the internal combustion engine;
a blow-off valve assembly disposed in a coolant passage and biased to seal the cooling passage when a pressure of the coolant is below a threshold;
an electro-mechanical actuating assembly configured to impart a force on the blow-off valve sufficient to overcome the sealing bias of the blow-off valve assembly;

and

an ECU configured to activate the electro-mechanical actuating assembly to maintain a desired operating temperature.

- [c10] 10. The outboard motor of claim 9 wherein the ECU activates the electro-mechanical actuating assembly to unseat the blow-off valve if coolant pressure is below the threshold and, if so, transmit an actuating commence signal to the actuating assembly to open the blow-off valve.
- [c11] 11. The outboard motor of claim 10 wherein the actuating assembly includes a solenoid controlled plunger and the ECU is further configured to transmit the actuating command signal to the solenoid controlled plunger based on engine speed and engine load.
- [c12] 12. The outboard motor of claim 11 wherein the ECU is further configured to compare an actual engine speed and load with a predefined map of engine speed and load data.
- [c13] 13. The outboard motor of claim 9 wherein the ECU is further configured to transmit the actuating command signals to the actuating assembly to maintain a relatively constant engine temperature for a specific engine speed

and load.

- [c14] 14. The outboard motor of claim 9 wherein the ECU is further configured to regulate the actuating assembly such that a maximum engine temperature is not exceeded.
- [c15] 15. A method of controlling temperature of an outboard marine engine comprising the steps of:
thermostatically regulating engine temperature when the engine is operating under a first set of conditions;
electro-mechanically opening a blow-off valve to reduce engine temperature when the engine is operating under a second set of conditions; and
hydraulically opening the blow-off valve to reduce coolant pressure in the coolant system when the engine is operating under a third set of conditions.
- [c16] 16. The method of claim 15 wherein the first set of conditions is defined by an engine temperature, the second set of conditions is defined by at least engine load, and the third set of conditions is defined by at least coolant pressure.
- [c17] 17. The method of claim 15 wherein the step of electro-mechanically opening the blow-off valve includes the step of actuating an electro-mechanical solenoid de-

signed to impart a force on the blow-off valve sufficient to unseat the blow-off valve.

- [c18] 18. The method of claim 17 further comprising the step of actuating the electro-mechanical solenoid by transmitting control signals based on engine speed and load.
- [c19] 19. The method of claim 15 further comprising the step of comparing instantaneous engine operating conditions to a look-up table of data detailing under what engine operating conditions the blow-off valve should be electro-mechanically opened.
- [c20] 20. The method of claim 15 wherein the second set of conditions includes an engine speed of at least 2500 RPM.